

A CRITICAL SURVEY OF URETERAL IMPLANTATIONS.¹

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INJURIES to the ureters take many forms, varying from the kinked ureter, as a result of twisting of adjacent tissue incident to the pulling of ligatures badly placed, to the unwitting removal of several inches of the organ.

Previous to 1877 there had been but two ways of dealing with a complete section of the ureter. These were the let-alone policy and nephrectomy, as established and practised in 1869 by Simon. And it is very probable that but for the popularity of nephrectomy, ureteral surgery would have had a much earlier elaboration. Quite in contrast with the ruthless destruction of function as represented by nephrectomy in such work is the case of Lange, of New York, in which several operations were done before nephrectomy was done. In this prompt adoption of the expedient of nephrectomy the only kidney has been removed. A case of nephrectomy was done in this country but a few years since in which the only kidney was removed as disclosed by the autopsy and anuria existed twenty-nine days before death claimed its victim.

The severed end of the ureter has been implanted into itself, the bladder, the urethra, the rectum, the colon, the cæcum, the vagina, and even to the skin. The pelvis of the opposite kidney and the opposite ureter as depots have not escaped consideration. Each of these plans of disposal of the functioning ureteral stump has its enthusiastic advocates, though it cannot be said they are alike applicable. These anastomoses are now being made for conditions other than

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complete sections of the ureter, ectopia vesicæ, tumors of the bladder, requiring its resection or exsection, and abnormal congenital ureteral endings have been the indications for bladder grafting in a number of instances.

Practically all are agreed that for severed ureter without much loss of tissue the best procedure is to unite the severed ends. This has been done by four principal methods, viz., the transverse end-to-end, the oblique end-to-end, the end-in-end, and the lateral implantation or end-in-side. The transverse end-to-end has been done twelve times by Schopf,¹⁰ Hochenegg,⁹⁰ Fritsch,⁹⁰ Cushing,⁹⁰ Tauffer,⁹⁰ two cases, Allen,¹⁰⁰ Durante,¹⁰¹ Gusserow,¹⁰² Busachi,¹⁰¹ Eiselsberg,¹ and Labisé.¹⁰³ Tauffer inserted into the cut ends of the ureter a piece of ureteral catheter held by a ligature around its middle and removed it just before tying the last sutures. Schopf's and Hochenegg's cases died in forty-two and twenty days, respectively, from conditions independent of the ureteral operation. Allen's case was unique as it occurred in the case of a horseshoe kidney, the removal of which was attempted with the impression that another kidney existed. After the ureter was severed, this mistake was fortunately realized and the cut ends united. He could not make the end-in-side anastomosis as the ureter was too short, and the injury was too high to transplant the upper stump into the bladder. The end-in-end has been done by McMonagle¹⁰⁴ in three cases, in all of which the ureter was dilated. In one of them the patient died of shock. Robson,⁹⁰ Winslow,¹⁰⁵ D'Antona,¹⁰⁰ and Markoe¹⁰⁷ have each modified this operation by splitting the lower end, and G. H. Noble, of Atlanta, has practised this modification twice, making nine times the end-in-end has been done with but one death. Markoe employed a ureteral catheter for closing and left it in place five days. The end-in-side implantation has been successfully followed in four cases by Kelly,⁹⁰ Doherty,⁹⁰ Emmet,⁹⁰ and Schauta,¹⁰⁰ and Reynier¹⁰⁸ has lost one case after this operation. The oblique end-to-end has been done but once and that by myself.⁹⁰ The patient is still (four years later) perfectly free from

any symptoms referable to the bladder or upper urinary passages. Thus it will be seen the divided ends of the ureter have been directly approximated twenty-seven times with two deaths, and in not one was there failure to unite or subsequent loss of function, although Schopf's tubercular patient had some ureteral dilatation above the site of union. In addition to these we find Seiffart,¹¹⁰ in removing a broad ligament tumor, accidentally resected a piece of the right ureter. The two ends were approximated and sewed in the abdominal wound. The original distance between them of two centimetres became gradually less, and after four months' union of the ends was continuous. The lower end had been kept patent by daily passing a sound. The function of the ureter after the four months seemed complete. This plan of treatment would seem to be exceedingly faulty, as, with all the granulation process near the cut ends of the ureter, narrowing of the lumen of the duct is almost certain to occur. And it is this result that is most feared in uretero-ureteral anastomosis. It has greatly worried experimenters, and led Van Hook to his unique implantation and myself to the oblique end-to-end plan.

There can be no doubt uniting the ureter ends is by far the best manner of disposing of the divided ureter, whenever it is possible. This method is applicable to the whole extent of the ureter, except practically the lower inch in the male and lower two inches in the female. It is but fair to state that accidental complete section of the canal during pelvic operations frequently occurs in the lower four inches of it.

It is difficult to decide which of the methods of uretero-ureteral anastomosis is, on the whole, the best. Loss of ureteral tissue by clamping or ligating the cut ends or by resecting the duct is a special feature requiring consideration in remedying the dilemma in which the surgeon is placed. In the different plans for uniting the two ends, except the transverse end-to-end, an additional loss of length of the duct is made. In the end-in-side method the loss must be at least one and a half inches. The lower end has to be ligated, and, beginning half a centimetre below the ligature, a longitudinal

slit one centimetre long is made in it. Through this opening is drawn the upper cut end by means of sutures passing outwardly through its wall some distance from its end. These sutures penetrate outwardly through the wall of the lower stump one centimetre below the incision (Van Hook and Kelly). In Robson's case of end-in-end anastomosis he states an inch of the length of the ureter was utilized in the operation, and in my case of oblique end-to-end union the loss was probably three-quarters of an inch. Another element of danger, perhaps over-estimated, because of the results of experimentation on the very small ureter of the dog, is subsequent narrowing of the calibre at the point of union. This is most likely by the transverse end-to-end and next by the end-in-end. In the lateral implantation method of Van Hook, there would be the theoretical constriction due to placing one end in the other, as in the end-in-end method. But this is theoretical, only, so far as operations on man are concerned. In the oblique end-to-end method this feature is obviated. The end-in-end and end-in-side plans are not so applicable if the upper end be dilated more than the lower, as occurred in Emmet's case, and will often result from pressure on the ureter at about the point of section. Were the lower end larger than the upper, a not likely condition, these methods would be especially indicated. The oblique end-to-end, however, is applicable to both these variations as well as to the normal. The slant on the dilated end need not be made at so small an angle with the longitudinal axis of the tube if the other end be normal in size. This permits of accurate approximation. No bad result from a slight angle at the point of union would result, as proven by the Van Hook method. The danger of leakage after operation is very slight, it having occurred in but one case. Theoretically it might follow any of those in which sutures have penetrated the mucosa. Whether the sutures thus passed are quickly covered by mucous membrane or whether cases may be recorded where calculi form after such operation is yet to be learned. Considering all conditions in a given case to which this operation is applicable not much choice exists, except in the

hands of surgeons devoid of usual deftness, when the end-in-end or end-in-side methods are perhaps preferable. And if considerable loss of length of ureter should be a feature, the preferable operation would be the transverse end-to-end, though careful suturing is necessary to prevent leakage. D'Urso and De Fabii¹¹¹ have made a number of experiments in making a lateral anastomosis between the two severed ends of the ureter as is done with the intestine. They claim to have been very successful. Monari⁴⁷ and Tuffier⁴⁷ have recommended the same method to avoid stricture. Generally the ends may be more easily approximated if the attachment of the duct be in part separated for a distance of a few inches above and below the point of section. The cases of Chrobak⁴⁷ and Ruhl⁴⁷ and the experiments of Margarucci⁴⁷ and Monari⁴⁷ demonstrate conclusively this may be safely done. Kaysar loosened it as far as the pelvic brim without untoward result.

Uretero-cystostomy.—I find recorded or quoted eighty operations of this kind done by sixty-five different operators. I have not been able to verify a few of these cases by studying the original reports. Probably this operation was first done by Tauffer⁴³ in 1877, he having accidentally cut off a ureter during an abdominal operation for the removal of a broad ligament cyst. He then successfully transplanted the proximal divided end into the bladder. This was eight years after Simon had done nephrectomy in a case in which some time before the ureter was cut off in removal of a broad ligament cyst. It is to be regretted that Simon's plan is yet resorted to for this indication, as I have learned was recently done in my city. The next operation was by Novaro, in 1893, and nearly all writers on this subject credit this as the first. Uretero-cystostomy is a much easier operation than ureteral splicing, and that it has been so frequently done during the past seven years is partly the result of that. The very large number of cases of uretero-vaginal and other ureteral fistulæ, however, more largely account for the large number of operations.

Of the thirty-seven bladder grafts for injuries of the

ureter during abdominal operations, we find fifteen were done by the intraperitoneal method. All of these were done at the time of injury with one death (Krause's patient), and that not connected with the operation, and two failed. By the extraperitoneal plan two were done. Of a number of other cases I was unable to learn the plan followed. In one failure is recorded. In most of the intraperitoneal operations the peritoneum was carefully closed over the site of the operation, making them nearly extraperitoneal. In twelve of these cases resection of the bladder was done for various conditions. The mortality was but a trifle over 2 per cent.

Of the cases done for various kinds of fistula or other conditions for which an operation was proposed and executed we find there were forty-two, of which twelve were by intraperitoneal operation, fourteen by extraperitoneal, and in sixteen the method was not mentioned. In two cases, those of Lange and Calderini, both ureters were successfully spliced, and in Fullerton's the spliced ureter was double, both parts being successfully grafted. Four died, one of them some time later, probably from pyonephritis, and another from an old chronic nephritis. This operation is indicated when in the course of an abdominal operation section of the ureter in its pelvic portion is made either accidentally or intentionally, splicing of the cut ends being impossible or inadvisable. The lower portion of the ureter may be diseased to such an extent as to demand extirpation or to render it useless, or it may be so short as to render splicing of the ends exceedingly difficult and unsafe. In the cases of Polk, Krause, and myself the ureteral section was elective with removal of the lower segment. Ureteral fistulae following operations, difficult labor or forceps delivery and abnormal congenital ureteral openings also call for this procedure. The latter condition was the indication in the cases of Baumm, Colzi, Davenport, Albarran, and Benkiser. Ferguson found of sixty-seven cases of ureteral fistula twenty-five were created in parturition, in sixteen of which forceps delivery was performed. In twelve vaginal hysterectomy was the cause; two by stone in the ureter and ulceration, three by

abdominal section; one had a traumatic origin, two from pelvic abscess; one from a pessary, one spontaneous, probably tubercular, necrosis of the ureter, as in Krause's case and marked undilatable stricture of the lower end, as was one of Israel's cases. In but a few of the uretero-vaginal fistulae can cure be procured by vaginal plastic surgery. The danger of relapse from heavy strain from cicatricial contraction is too great to permit this plan to be adopted in any but the most favorable cases. The methods of bladder grafting of the ureter are principally by the abdominal route. Colzi in one case severed the genital organs on one side from the pubes, cut away part of the lower portion of the pubic arch and transplanted an abnormally ending ureter into the bladder, and Baker, Davenport, and Benkiser, operating from the vagina, severed the ureter above the fistula and transplanted into the bladder. These operations are very difficult, and Colzi's procedure in the light of our present knowledge of ureteral surgery will scarcely be repeated. The abdominal route is far superior for vesical anastomoses with the ureter. By this route the splicing may be done by the intraperitoneal or the extraperitoneal method. When possible, the extraperitoneal will naturally commend itself. As pointed out by Martin, suturing the peritoneum tightly over the ureter endangers subsequent constriction of the ureter. Veit has modified the extraperitoneal method by bringing the cut proximal end up to the abdominal incision and suturing it there, and then by bringing bladder up extraperitoneally to meet it, anastomosis was made. Various modifications of both the intra- and extraperitoneal methods have been made to meet the given conditions.

The principal methods that have been employed are those of Witzel,⁹¹ Veit,⁴⁰ and the so-called Fritsch-Kelly,⁹⁰ all extraperitoneal practically, though in the two former the peritoneal cavity is opened as a preliminary step. Baumm has also done a purely extraperitoneal grafting of the bladder by a suprapubic incision. Baker⁷⁶ also did a vaginal extraperitoneal graft of ureter into bladder successfully. There can be no question but

exposure of the peritoneal cavity should be avoided whenever possible in making these anastomoses, and particularly is this important if the ureter or bladder be diseased or conveying abnormal urine; but in the class of cases in which the ureter is injured during the progress of an abdominal operation we cannot draw such fine lines. A considerable interest has been manifested in the manner of attaching the ureter to the bladder. Pozzi found a marked distention of the ureter ten months after the operation, which he attributed to reflux of urine from over-distention of the bladder, and Polk found the same condition resulting from constriction at the point of union. An effort has been made to imitate the normal oblique bladder implantation of the ureter to prevent reflux, and splitting of the end of the implanted ureter has been employed to prevent constriction. In quite a number of cases the operation failed from lack of union, generally due to too great tension on the tissues of both ureter and bladder. This has been overcome in a few cases by means of traction sutures placed in the end of the ureter in the bladder and brought out through the urethra, where they were sutured to the end of the urethra (Krause) or attached to dressings. In one case (Kaysar) the sutures were weighted for five days with 200 grammes. All these were successful. Kelly and others have stitched the bladder higher in the pelvis to broad ligament or other structures to prevent downward traction on the sutured junction. To me this is a better plan than weighting the end of the ureter, as there will be less tendency to narrowing the junction by future tension.

The fact, as shown by the statistics, that a few cases have leakage would seem to make drainage a necessity. Martin, of Berlin, however, believes drainage dangerous, as preventing rapid union by causing too much irritation. But to allow an escape of urine without affording it an outlet seems contrary to surgical principles.

It is impossible to make an anastomosis between ureter and bladder as good as the natural one, because the small muscles attached to the ends of the ureters and lost in the wall of

the bladder near the internal meatus cannot be utilized. Their function is to draw down the orifice of the ureter when the bladder distends, thus preventing loss of obliquity of that duct through the distended bladder wall. Of course this same disadvantage accrues in all forms of implantation of the lower end of the ureter, except, perhaps, in the plans of Maydl and the Italian surgeons, Pozza and Capello, in rectal grafting of it, in which a small portion of it is retained with the ureter ends. The plan of Boari²² does not convey to me any advantages. He has applied it in rectal and bladder transplantations of the ureter in animals, and in bladder anastomosis once successfully on a man, and Casati once with a fatal result in thirty-five days. The importance of careful surgical technique is here very greatly emphasized, as a slight infection may render the operation unsuccessful and endanger ascending infection along the ureter.

Whenever the ureter requiring grafting is above the brim of the pelvis and ureteral anastomosis with itself or the bladder seem impossible, its implantation into its fellow is to be considered. If this be decided impracticable, then loosening and downward displacement of the kidney, thus far done only experimentally, may be employed to permit these anastomoses. Should these be found impossible, then grafting into the bowel will be justifiable. As double ureter is occasionally met with as well as anuria of the affected side, we should have these in our minds and deal with them accordingly.

The only case of the kind that has occurred in my practice was in a woman fifty-two years of age operated, April 4, 1898, for cancer of the uterus. A wide abdominal hysterectomy was done, removing as much of the ligaments as possible after isolating the ureters. The upper half of the vagina was dissected away from above, and the specimen thus loosened was withdrawn from below. In following the left ureter towards the bladder it was found slightly dilated and passing through a mass of cancerous infiltration. It was ligated at its junction with the bladder, cut away at this point as well as above the cancerous mass mentioned, and the piece, about two

inches in length, removed. A small opening had been made in the bladder during the separation of the uterus and vagina from it, and through this a pair of forceps was introduced and made to return through another opening made to receive the ureter end. They now grasped the ureter end, pulled it into the bladder, and held it while it was carefully sutured to that viscus by means of fine catgut. The forceps were withdrawn and the accidental bladder wound closed. The peritoneum from behind and that covering the bladder were sutured, closing the peritoneal cavity. The abdominal wound was closed and the wound lightly packed with gauze from the vaginal side. A small nick with the scissors had been made in the ureter an inch above the junction, but it was not thought to enter its canal. The whole operation lasted three hours. Permanent catheterization was not satisfactory, and frequent use of the catheter had to be employed instead. April 11, slight discharge of urine from the vagina appeared, and continued to May 5, when it stopped for a few days to again reappear. Specular examination of the bladder showed urine coming into it from the right ureter and from a point high to the left, thought to be the left ureteral opening. With the exception of the slight discharge of urine from the vagina she was feeling excellent, and was voiding from thirty-six to fifty ounces of urine daily. I was in doubt as to whether the union of ureter and bladder was incomplete or the leakage was from the injury to the ureter higher up. Having waited for a possible return of cancer, I finally yielded to the wish of the patient and operated to close the abnormal urinary opening November 14, 1898. Upon opening the abdomen a mass of adhesions was found in the region of the ureteral injury. A small probe passed into the bladder was easily made to pass into the ureter, and the slight opening in it was found to be connected with the bladder and vagina by a Y-shaped fistula. The bladder opening was probably in the line of the suturing to close the wound accidentally made during hysterectomy. As the uretero-vesical opening seemed too narrow, it was thought advisable to remove the portion of the ureter below the fistula, which was done and

uretero-cystostomy repeated. The vaginal portion of the fistula was enlarged, and in it placed a narrow strip of gauze. This was kept in place with occasional changing until danger of leakage was passed. She made an excellent recovery, and now weighs more than 200 pounds, which is evidence of no return, thus far, of the cancer.

CASES OF BLADDER IMPLANTATION OF URETER FOR URETERAL INJURIES DURING ABDOMINAL OPERATION.

- (1) Tauffer.⁴³ In removing a broad ligament cyst accidentally cut off the ureter, and successfully transplanted it into the bladder, intraperitoneally.
- (2) Westermarck.⁴⁴ Did a successful transperitoneal graft.
- (3) Dunning, L. H.⁴⁵ Injured ureter during removal of an abscess from the pelvic structures; transperitoneal implantation into bladder; success.
- (4) Matas, R. (personal communication). In removing a large fibroid of the uterus, in 1895, found urine spurting from a completely severed ureter, one and a half inches from bladder; successful intraperitoneal bladder graft.
- (5) Lannelongue.⁴⁶ " An unsuccessful bladder graft of the ureter.
- (6) Israel, James.⁴⁷ Extraperitoneal bladder graft for stricture of ureter; fistula resulted, requiring a second operation; successful.
- (7) Veit.⁴⁸ Did an extraperitoneal operation by bringing severed ureter out of abdominal incision at point where it passed abdominal wound, where it was fixed by two sutures between fascia and peritoneum; skin incision carried to symphysis and bladder opened extraperitoneally on anterior surface; ureter cut obliquely and sutured into bladder; recovery.
- (8) Pozzi.⁴⁹ Injured ureter during operation and grafted into bladder; nine months later did herniotomy and found ureter the size of femoral artery, which he considered due to reflux from bladder when urine was held too long.
- (9) Schwartz.⁵¹ Case of transperitoneal graft of ureter in bladder; recovery.
- (10) Baldwin.⁵² Operation for sarcoma of fundus uteri; cut out one and a half inches of ureter; could not make uretero-ureteral anastomosis, as loss was too great; did bladder graft and, as tension was great, sutured bladder to broad ligament; recovery.
- (11) Baldy.⁵³ Ureter embedded in inflammatory tissue; it was severed and grafted into bladder intraperitoneally; success.
- (12) Penrose.⁵⁴ Cancer uterus, abdominal operation, lower portion of ureter involved and resected; grafted successfully into bladder.
- (13) Krug.⁵⁵ Same as Baldy's; success.
- (14) Delageniere.⁵⁶ A successful case.
- (15) Fith.⁵⁷ A successful case.

- (16) Polk.⁶⁸ Same indications as case of Penrose; return of disease, and secondary operation, at which he found ureter dilated, as the duct was too much constricted at lower end.
- (17) Fullerton.⁶⁹ A successful case of grafting a double ureter.
- (18) Graupner.⁷⁰ Same as Krug's; transperitoneal; successful.
- (19) Lotheissen.⁷¹ Same as Krug's; transperitoneal; successful.
- (20) Veit.⁷² Operation on adnexa; bladder graft; successful.
- (21) Olshausen.⁷³ Operation on adnexa; bladder graft; successful.
- (22) Podres.⁷⁴ Operation on adnexa; bladder graft; successful.
- (23) Hanks.⁷⁵ Transperitoneally; one case; successful.
- (24) Noble.⁷⁶ An unsuccessful intraperitoneal operation.
- (25) Wertheim.⁷⁷ Operation, May 30, 1899, for intraligamentary uteromyoma; accidental severing ureter; implanted into bladder by means of a sling and knotted silk sutures; success.
- (26) Israel.⁷⁸ Resected bladder for cancer and removed lower end of ureter, implanted stump at a new place; recovery.
- (27) Schuchard.⁷⁹ For bladder resection; success.
- (28) Poppert.⁸⁰ For bladder resection; success.
- (29) Krause.⁸¹ For bladder resection; died.
- (30) Westermarck.⁸² For bladder resection; success.
- (31) Albarran.⁸³ For bladder resection; success.
- (32) Verkoogen.⁸⁴ For bladder resection; death in two hours.
- (33, 34) Küster.⁸⁵ For bladder resection; two cases.
- (35) Bardenheuer.⁸⁶ For bladder resection; success; patient died five months later from other trouble.
- (36) Wertheim.⁸⁷ Operation, December 5, 1895, for papilloma of bladder and involvement of left ureter; removal of tumor, part of bladder wall, and ureteral orifice; implantation ureter into the bladder-hole; death in forty-two days.
- (37) Wertheim.⁸⁸ Removal of tumor with portion of uterus; seven centimetres of ureter and portion of rectum; leaving stump of ureter two centimetres long; implantation with great difficulty; fistula established by latter July, and death occurred shortly after.

CASES OF BLADDER IMPLANTATION OF URETER FOR URETEROVAGINAL AND OTHER URETERAL FISTULÆ.

- (1, 2) Novaro.⁷² Did two successful cases for ureterovaginal fistula after vaginal hysterectomy.
- (3) Martin, A.⁷³ Case failed by vaginal route and was successful by the abdominal; extraperitoneal graft.
- (4) Kaysar.⁷⁴ Thirteen days after hysterectomy urine noticed coming through abdominal incision; cut down and did bladder graft; sutures drawn out urethra and fastened to dressings; flow gradually stopped; catheter à demeure; imperfect result, and operation repeated five months later; for five days fastened a weight of 200 grammes to sutures; success.
- (5) Ferguson.⁷⁵ Transperitoneal; successful for uretero-abdominal fistula after abdominal operation.

- (6) Calderini.¹⁶ Ureterovaginal fistula; transperitoneal graft; success. This case was in both ureters.
- (7) Sokoloff.¹⁷ Successful transplantation after forceps delivery.
- (8, 9, 10) Bazy.¹⁸ Three successful cases, one requiring a second operation; all for ureterovaginal fistula following vaginal hysterectomy.
- (11) Trendelenburg.¹⁹ A successful case.
- (12) Boldt.²⁰ Successful transperitoneal case for ureterovaginal fistula.
- (13, 14, 15) Mackenrodt.²¹ Three cases by the Fritsch-Kelly method, and the first died from nephritis unconnected with the operation.
- (16) Lotheissen.²² Transperitoneal; success.
- (17) Albarran.²³ Abnormal attachment of ureter; successful.
- (18) Colzi.²⁴ Abnormal orifice of ureter in vagina, congenital; incised above and outside labium major, detaching genitals from arch of pubes, cutting away some of the bone from the lower surface of arch to reach base of bladder; abnormal ureter cut across and sutured into place; success.
- (19, 20) Rouffart.²⁵ Two cases transperitoneal after ureterovaginal fistula; one died.
- (21, 22) Bushbeck.²⁶ Transperitoneally for ureterovaginal fistula; the second failed, and nephrectomy was done.
- (23, 24) Tuffier.²⁷ Two cases done transperitoneally for ureterovaginal fistula.
- (25) Routier.²⁸ One successful case after forceps delivery.
- (26, 27) Amann.²⁹ Two such cases; success.
- (28) Snger.³⁰ One such case; success.
- (29) Baker.³¹ Extraperitoneal, vaginal, successful.
- (30) McMonagle.³² For ureterovaginal fistula after laparotomy; success.
- (31) Witzel.³³ Extraperitoneal; vaginal had failed; success. His method is as follows: The bladder was detached and drawn out. The thickened ureter was severed at about the middle of its course through the broad ligament; the lower end closed by sutures, and the upper end brought to the upper part of the incision at the brim of the pelvis, drawn down beneath the peritoneum above the innominate line by a pair of long forceps started upward under the peritoneum. The incisions in the pelvic peritoneum and median line of abdomen were closed, and the remainder of the operation done extraperitoneally. The bladder was then brought above the middle of the iliac fossa, where it was fastened with catgut sutures. The obliquely cut ureter was now inserted into bladder-incision, the mucosa of bladder and ureter being united by fine catgut and another row outside of it attached to ureteral and vesical walls. An oblique channel through the bladder was formed by uniting the bladder walls over the ureter on both sides.
- (32) Davenport.³⁴ Case similar to Colzi's; success.
- (33) Baumm.³⁵ Same as Davenport's. Accessory ureter opening into urethra; incontinence. Suprapubic, extraperitoneal. Misplaced ureter divided; proximal end in bladder; recovered.

- (34) Amann.⁸¹ Another successful case for ureterocervical fistula. Bladder raised by sound and oblique grafting done; success.
- (35) Krause.⁸² Intraperitoneal (following vaginal hysterectomy); cut off ureter; split the end and spliced into bladder, suture through each lip of ureter brought out and sutured to external meatus urinarius; successful.
- (36) Kelly.⁸³ Ureterovaginal fistula after vaginal hysterectomy. Loosened bladder from attachments and spliced; extraperitoneal; success.
- (37, 38) Kelly.⁸⁴ Ureterovaginal fistula after vaginal hysterectomy; did extraperitoneal operation on wrong ureter, in the first case, by wrong direction of catheter; it failed, and he closed both ureterovaginal fistulae by vaginal plastic operation. The second was done by the Fritsch method, and the patient died from pyelonephritis (probably).
- (39) Lange.⁸⁵ Hysterectomy for cancer by another surgeon; pyonephrosis with right nephrotomy nine months later; a month from then median incision and both ureters implanted in fundus of bladder. Silk suture brought out urethra and tied over short piece of drainage-tube. The right failed, and two months, suprapubic cystotomy and successful anastomosis; five months, left pyonephrosis and nephrectomy; success.
- (40) Wertheim.⁸⁶ Uretero-uterine fistula following removal of ovarian cyst. Operation January 3, 1896, extraperitoneal, changing to intraperitoneal; implantation of ureter into bladder; death in thirty-five hours.
- (41) Schauta.⁸⁷ Vaginal fistula; bladder implantation; nephrectomy five months later; success.
- (42) Benkiser.⁸⁸ Supernumerary left ureter opening into vagina; ureterocystotomy; success. This was probably a vaginal operation.

Rectal Implantation.—A very large field for this operation has been developed in the treatment of ectopia vesicæ, benign and malignant growths of the bladder requiring its complete extirpation, of injuries of the ureter irremediable by ureteral or bladder anastomoses, and Chalot has implanted successfully both ureters into bowel during operation for uterine cancer involving bladder in which he ligated the internal iliac arteries, and extirpated both uterus and bladder. It seemed necessary to place rectal graft of the ureter among the justifiable operations, as cases occasionally occurred in which some disposition of the ureter had to be made, and no other alternative but nephrectomy was accessible. The many hundreds of experiments made on animals by Gluck and Zeller, Novaro, Ceci, Bardenheuer, Reed, Van Hook, Tuffier, Chaput,

and a host of others proved unsatisfactory. In fact, like the other methods of ureteral grafting, animal experimentation did not compare at all favorably with the same work on man. This is probably attributable to the much smaller size of the ureter in dogs, the greater difficulty of carrying out asepsis in the operation, and the difficulty of keeping animals quiet during the next few days after operation, so necessary to good union. Inasmuch as the operation has now been done sixty-five times on man, it is certainly not too early to consider its merits and defects. The recorded mortality has been eighteen, or a little less than 30 per cent. But six of them have died from the shock and severity of the operation for the condition calling for the grafting. But in at least seven cases death resulted from five days to two years after operation, from infection of kidney, peritonitis, or other untoward result of the rectal grafting. In five cases the cause of death was obscure. In Tuffier's case, much vaunted as being the first successful complete extirpation of bladder in man, death occurred nineteen months after operation, and he gives no details of the cause. As the operation was done for bladder epithelioma, the fatal result may have been from malignant disease. In two cases the result is not published. When we consider that of deaths from all causes 40 per cent. are from subsequent infection, the suspicion that some of the reported successful cases may also later succumb to infection is certainly reasonable. The high mortality rate of such a procedure must necessarily cause great anxiety as to its justifiability, and were it not for the most excellent work of Maydl, followed so successfully by a number of other surgeons, we might look upon the subject with almost condemnation. However, when we consider that but eight deaths have resulted in the operations done by his method, a mortality rate of but 21 per cent., we readily see the operation has been markedly rid of its terrors. The danger of subsequent kidney infection and peritonitis has been very greatly reduced.

Methods.—Anastomosis between ureter and rectum has been done by five different methods, viz., (a) by the formation

of a fistula between them; (*b*) by the axial implantation of the ureter stump into the bowel, and its fixation there by means of the Lembert or the double row suture; (*c*) implantation of both ureters with a piece of the bladder, as by Maydl, Pozza, and others; (*d*) implantation of both ureters with a small amount of the bladder mucous membrane, and (*e*) by means of apparatuses, such as those of Chalot and Boari. Simon did the first operation akin to this subject by passing a loop of thread in such a manner as to cause ulceration between rectum and ureter in a case of ectopia vesicæ. While urine continued to come through exposed bladder, the recto-ureteral fistula remained open. Then Smith, in ectopia vesicæ, implanted the right ureter into ascending colon, and fourteen months later the left ureter into descending, but this proved fatal in twenty-four hours. The autopsy showed not only infection of right kidney, but obstruction at point of anastomosis on both sides. Then Küster, in 1896, failed, with a death from peritonitis and ascending pyelonephritis in five days. Chaput in September, 1892, successfully implanted a ureter for ureterovaginal fistula following vaginal hysterectomy, and at the end of one year there was no evidence of infection. Two months later he implanted both ureters in the rectum three months apart, and death occurred from suppression of urine the day of last operation. His plan was as follows: Make incision through abdominal wall from costal cartilages, about ten centimetres, to side of median line, down to opposite the anterior superior iliac spine, and then curve to two centimetres of median line, the intestines held aside and post-peritoneum incised ten centimetres long in iliac region, and internal flap stripped up to spinal column. Ureter cut between forceps. Inferior portion ligated and replaced. Superior portion held in contact with posterior internal aspect of colon and sutures inserted. Posterior lip ureteral orifice is first fastened to intestine by three or four sutures through muscular layers only. Intestine incised one centimetre several centimetres from preceding sutures. Mucous membrane of posterior flap of the two orifices now sutured, and then anterior lips by row su-

tures through muscular layers; a few extra sutures at end of incisions, then ureter covered over by sero-serous sutures in the intestinal wall.

Fowler makes an incision in the median line, and with patient in Trendelenburg position. The rectum is cleansed; the posterior layer of peritoneum is incised sufficiently to expose the ureters freely. They are traced to their termination on the bladder wall, from which they are detached and their ends cut obliquely; a longitudinal incision of seven centimetres is made in the anterior wall of the rectum through the serous and muscular coats; edges are retracted, making a diamond-shaped space in the exposed submucosa; a tongue-shaped flap of mucous membrane with its base upward is cut from the bowel in the lower half of the diamond. It was doubled upward on itself so that its mucous surface presented anteriorly, where it was secured by one or two catgut sutures, making a flap on both sides covered with mucosa. The ureters are now placed in the incision with their obliquely cut ends lying upon the presenting mucous membrane flap. Two catgut sutures hold them there, and two more are placed in the space in the upper half of the diamond, not penetrating the ureter. The flap valve and attached end of the ureter are now pushed into the cavity of the rectum and the wound closed; the gap in the mucous membrane by reflection of the tongue-shaped flap is sutured by running catgut. Then original wound in the rectal wall is closed with fine silk sutures, the upper two or three being also used for still further securing the ureters where they pass into the submucous space in the upper half of the diamond.

Krynski's¹¹² plan was nearly the same, except that he made an isosceles triangular flap with the detached base below through all the bowel coats except the inner, and then through this he made an opening, at the base of the flap, of sufficient size to admit the end of the ureter, which was sutured in place and covered by the flap. Maydl's method is to transplant both ureters with an elliptical piece of the trigone of the bladder, *en bloc*, into the rectum or sigmoid. Gersuny converted the

rectal pouch into a receptacle for urine only by making an artificial anus and shutting off the upper part of the rectum entirely. Mauclore and Tizzoni divided the sigmoid from the rectum and drew it down to the sphincter ani, sewing it to the anterior rectal wall, thus emptying the ureters into a segment of bowel where fecal matter would hardly present itself. Peters operated extraperitoneally. The Vignoni method is nearly the same as Fowler's; Pisani¹¹³ carried the ureter across the calibre of the rectum and inserted it into the posterior wall. Beck allows a free end of the ureter to project into the rectum. Martin¹¹⁴ uses the Trendelenburg position, and makes a longitudinal incision of the peritoneum over the ureters down to their insertion into the bladder, and dissects out with his finger the lower three inches of them; ties each ureter near the bladder with strong silk and severs them above; brings each forward and approximates them in front of the rectum by including the wall of each with one fine silk suture armed at each end with a fine cambric needle. He approximates them further by two fine silk sutures passing through the outer walls of the ureters only, securing the two tubes parallel. He now makes a longitudinal incision two inches long through the peritoneum and subperitoneal tissue of the bowel, and dissects back this tissue, so that an oval space of muscular coat of the intestine is exposed the length of the primary incision in the bowel and one inch wide at the centre. The flaps are held apart, the bowel freed of fecal matter, and secured above by a clamp. A small incision is now made through the remaining coats of the bowel about large enough to admit the two ureters without pressure, and about one-third the distance from the lower end of the oval denudation. A double-threaded suture is now passed through the opening into the interior of the bowel. This has been previously placed in the ends of the two ureters. The needles are brought out a slight distance apart shortly below the denudation and about one inch from the opening made for the ureters; they draw the ureters through the opening and to the points at which they pass out of bowel. Elevate ureters at a right angle to the bowel, secure

them to the fibrous and muscular coats of the bowel by a number of closely applied sutures, not to penetrate the mucosa of nor to constrict the ureter. Ureters are now laid parallel to the bowel on the denuded portion, the handling sutures made taut, and additional ones passed, securing ureters to the muscular coat of the bowel as it is rolled in by the tension made on their ends. The ureters are now buried in the muscular coat and the peritoneum covered over it. Petersen¹¹⁵ has made lateral implantation on animals, of which he will make full reference in his paper.

Unquestionably, when both ureters are to be transplanted, and Maydl's operation, or Pozza's modification of it, are applicable, they are the best. But in many cases the ureters must one or both be resected and implanted in the rectum or colon. In such cases we cannot rely upon the buttons of Boari or Chalot, as the danger of constriction or of too large an opening at the point of junction is greater with them. As the danger of infection of the kidney is to be avoided, the methods of Fowler, Krynski, or Martin seem to be best. The plan of leaving a free end of the ureter in the calibre of the bowel, as done by Beck, may prevent infection, but to me it would seem the interference with the blood supply of this portion would cause it to slough. To me it seems the danger of reflux of urine is great, and if this is guarded against great care is necessary to prevent obstruction at this point. The operation of making an artificial anus at the iliac region and shutting off fecal matter, as practised by Gersuny, may be indicated. But to me there appear to be no cases calling for so much work with such slight results. Even the better plan of Tizzoni and Mauclaire would not be applied often. We naturally turn to view the practical results of rectal grafting of the ureter, and we find in most cases there exists an intolerance on the part of the rectum for some time. The movements are frequent, and the pressure of the urine against the wall where the ureter enters is usually too slight to prevent ascending infection along the ureter with reflux of the urine. But this is not always present. In Peters's case there was rectal

tolerance from the first, and many that have suffered early from this trouble have later become practically inured to it. In some cases constipation has been removed by this operation; and in one of von Eiselsberg's cases a preceding chronic diarrhoea was immediately checked. It is probable the carefully made oblique or longitudinal graft will be devoid of the danger of infection; but it is to be feared in all cases. With the progress of surgery daily developing new fields and the newer technique, we must expect this operation to be rapidly popularized.

CASES OF BOWEL IMPLANTATION OF THE URETER.

- (1) Simon.¹ In 1851; a loop of thread, passed in an ingenious manner, was made to ulcerate through contiguous portions of ureter and rectum in a case of exstrophy of bladder in a boy thirteen years of age. Communication resulted and continued, though urine escaped by skin, and patient died of suppurative pyelitis at end of one year.
- (2) T. Smith.² In 1871 grafted each ureter into colon on corresponding side for exstrophy of bladder; operation on left side fourteen months after right; death in twenty-four hours. Necropsy; left kidney hydronephrotic from stenosis (probe passed along ureter would not enter bowel); obstruction at point of graft on right side; kidney showed chronic changes.
- (3) Küster.³ For cancer of prostate involving bladder did cystotomy, liberating bladder from peritoneum; then median perineal incision eight centimetres long; cut and isolated urethra below prostate; returning to hypogastrium, cut ureters and lifted bladder and prostate together; transplanted ureters into rectum; sutures did not hold; death on fifth day of peritonitis and ascending pyelonephritis.
- (4) Chaput.⁴ September 13, 1892, for fistula communicating with vagina and a point high in ureter, following vaginal hysterectomy; ureter dilated; anastomosis made with posterior surface descending colon; drain in post-peritoneal space. One year later no infection had occurred.
- (5) Chaput.⁵ Tubercular cystitis and vesical fistula following operation; ureters implanted into rectum three months apart; suppression of urine; death same day.
- (6-10) Maydl.⁶ Reports five cases done by his plan for ectopia vesicæ, one of which died of prolonged narcosis; four cured.
- (11, 12) Duplay.⁷ For tubercular and other bladder disease did two cases, both of which died. No method explained.
- (13) Kossinski.⁸ In 1894 did vaginal hysterectomy and cystectomy for cancer successfully, and implanted ureters into bowel.
- (14) Rein.⁹ Ectopia vesicæ, Maydl operation, suturing in two layers, momentary results good, but according to Boari¹⁰ abscess formed some time after, and the patient died.

- (15) Resegotti.¹¹ Did a Maydl operation for ectopia vesicæ; success.
- (16) Trendelenburg.¹² Tubercular left kidney and bladder; removed them, and successfully grafted right ureter into colon.
- (17) Vasilyeff, M. A.¹³ For malignant disease of bladder did a successful Maydl operation.
- (18) Tuffier.¹⁴ Alveolar epithelioma of bladder in a man; cystectomy, October 20, 1895, with rectal graft of ureters; died May 14, 1897. Details surrounding last of illness and death not given.
- (19) Leet.¹⁵ Implanted one ureter into rectum; death from irrelevant cause at a some later time; autopsy showed no dilatation or infection.
- (20) Bergenhem, B.¹⁶ Removed bladder and successfully implanted ureters into rectum by Maydl's method.
- (21) Schinkler.¹⁷ Unsuccessful Maydl operation, January 27, 1895.
- (22) Krynski.¹⁸ Did a successful Maydl operation for ectopia vesicæ.
- (23) Chalot.¹⁹ In a case of cancer of uterus removed uterus and implanted both ureters obliquely into rectum, the right an inch below the left; success.
- (24) Trombetta.²⁰ Did a successful Maydl operation for ectopia vesicæ.
- (25) Wölfler.²¹ Did a successful Maydl operation for ectopia vesicæ.
- (26) Casati.²² Vesical tuberculosis; Boari button used for grafting left ureter into colon; death in thirty-five days.
- (27) Boari (*loc. cit.*). Vesicovaginal fistula with complete destruction of urethra; successful graft in rectum with button.
- (28) Herczel.²³ May 25, 1897, did successful Maydl operation for ectopia vesicæ in a boy of five years, removing bladder and inserting both ureters into sigmoid, right at upper and left at lower end incision.
- (29) Mikulicz.²⁴ Maydl operation; pyonephrosis; defective continence and death in four months.
- (30) Park, Roswell.²⁵ Maydl operation for ectopia vesicæ; death.
- (31) Fritsch.²⁶ A fatal case of rectal implantation of ureter.
- (32) Fowler, G. R.²⁷ Did his operation successfully in a case of ectopia vesicæ.
- (33) Kummel.⁸ Removed bladder of a woman in 1892, and was unsuccessful with rectal grafts of ureters.
- (34, 35) Frank.²⁸ Two successful Maydl operations for ectopia vesicæ.
- (36, 37) Schnitzler.²⁹ Two cases of rectal graft of ureters for tubercular and other diseases of the bladder; one died.
- (38) Tuffier.³⁰ Successful modified Maydl operation for exstrophy in boy of fifteen.
- (39) Pressat.³¹ Successful sigmoid graft of ureter.
- (40) Boari.³¹ Successful Maydl operation (with additional piece of bladder mucosa) for exstrophy.
- (41) Crespi.³¹ Successful case done as Boari's, December 8, 1896.
- (42) Cappello.³¹ Did a successful Pozza operation for exstrophy.
- (43) Pozza.³² Modified Maydl operation in a successful case for exstrophy of bladder by grafting a considerable portion of the trigonum with vesical end of ureters.

- (44, 45) Ewald.³³ Two successful cases of grafting ureters into sigmoid for ectopia vesicæ.
- (46) Peters.³¹ Ectopia vesicæ and rectal prolapse to knees in a child five years of age; extraperitoneal lateral implantation of ureters into rectum; rectal tolerance at once; five weeks after operation urinates every three to five hours during daytime and four to five hours at night.
- (47) Cameron.³⁴ Operated in a case of nineteen years' duration.
- (48) Wood.³⁵ Fowler's operation for ectopia vesicæ in one case; died two months later from kidney infection; high graft.
- (49, 50) Herczel.³⁶ Reports two more successes same as No. 28.
- (51-57) Von Eiselsberg.³⁷ Reports seven Maydl operations, with three deaths.
- (58) Wölfler.³⁸ Reports another successful Maydl operation.
- (59) Von Winiwarter.³⁹ Ectopia vesicæ; successful Maydl operation.
- (60) Allen, D. P.⁴⁰ Ectopia vesicæ; successful Maydl operation.
- (61) Gersuny.⁴⁰ Divided rectum from sigmoid flexure, closed upper opening in rectum and implanted into it the ureters and a part of the bladder wall, thereby forming a new bladder, end of flexure carried down through Douglas's pouch and through the sphincter, where it was sutured; success.
- (62) Nové-Josseland.⁴¹ For ectopia vesicæ did a successful implantation by method differing from Maydl's in that the removal of the bladder is not done until after the graft is made.
- (63) Beck, Carl (personal communication). Inserted ureteral ends with trigonum into rectum for ectopia vesicæ; successful.
- (64) Beck, Carl (*Ibid.*). Grafted both ureters into sigmoid, with total exclusion of bladder for tuberculosis of bladder from infection of it after operation for tubercular fistula in ano. Tunnelled bowel wall and left portion of ureters hanging free in bowel to prevent infection. Operation has been done eight months, and no evidence of infection exists.
- (65) Albarran.⁴² Ureterocolostomy in continuity of ureter done in 1899; death. Autopsy showed the kidney connecting with colon was tubercular, and the other ureter was obstructed with a tubercular mass.

Skin Implantation of the Ureter.—Grafting the ureter to the skin was very strongly recommended by Edmunds and Ballance¹¹⁰ as the best method of diverting the ureter in case of injuries to it, and especially when the bladder is to be removed. Their conclusion was reached after a series of experiments on cadavers at St. Thomas's Hospital, in 1887. Trekaki¹¹⁷ has written a long Paris thesis, in which he enthusiastically recommends it, and gives at length the indications for it. He experimented on two dogs.¹²⁸ In one, suppuration

occurred on one side and kidney infection resulted, but no other trouble was noticed in either dog; though in the second one but one ureter was diverted to the skin. The history of this plan of diverting the ureter, however, is by no means encouraging. Especially is this true when we consider its many most excellent alternatives. It is sometimes difficult to decide between skin and intestinal graft in cases in which the upper part of the ureter is injured, and but these two methods of saving the function of the corresponding kidney are possible. It is believed the danger of infection from skin implantation is the greater, and that nephrectomy is to be expected. Rydygier attempted to restore the course of the urine by bringing both ends of the severed ureters to the skin, and by means of a skin tube connecting the two ends, sewing over it the skin. Nussbaum¹¹⁸ implanted both ureters into the skin. Laurenzi,¹¹⁹ of Rome, in the course of a laparotomy for removal of a cyst of the mesentery, injured a ureter and fixed the end to the abdominal wall. Le Dentu¹²⁷ cut off the left ureter englobed in a cancer mass, and transplanted the upper end to the flank. Death from extension of the disease occurred in thirteen days. Pozzi, in 1891, removed a retroperitoneal parovarian cyst and made a lumbar graft with subsequent nephrectomy. Chalot, October 24, 1892, grafted both ureters to the flanks in abdominal hysterectomy for cancer, with a rapidly fatal result. Kufferath,¹¹⁷ in 1892, injured a ureter in the course of an operation for the removal of an ovarian cyst; grafted it to the skin. Budinger¹²⁰ cut off the right ureter in a hysterectomy and sutured the stump to the abdominal wall with the uterine stump; infection; twenty-one days later attempted nephrectomy and found a large renal abscess, which he incised. Twenty-two days later a sound could not be passed far along the ureteral fistula, and no excretion of urine from it occurred. C. P. Noble, in removing an ectopic pregnancy, cut out considerable of the ureter and implanted it to the skin preparatory to nephrectomy, which was done subsequently with success. Harrison,¹²¹ in 1897, in a case of ectopia vesicæ with an infection of one kidney and suffering with scarlatina,

did nephrectomy, and grafted the ureter of the other side to the skin of the loin. Fullerton,⁵⁹ in 1898, in removing a large intraligamentary cyst, cut off a ureter and implanted it in the abdominal wound with a long flexible catheter in it. Death from recurrence of the disease occurred four months later. There was no discharge from the catheter at any time.

Thus it will be seen skin grafting of the ureter has been done ten times. In Chalot's case death occurred from shock. In Noble's, the operation was considered a *dernier ressort*, and a successful nephrectomy was done. The result in the cases of Laurenzi,¹²⁷ Kufferath, Nussbaum, and Harrison is not given. Budinger's was a clear case of ascending infection, and in his as well as in Fullerton's the kidney function had been terminated before operation, or as a result of it. In Le Dentu's case extension of the disease caused death in thirteen days, and in Fullerton's at the end of four months. In Le Dentu's case one can hardly understand the indication for such a procedure thirteen days before cancer caused death, and in Fullerton's I was unable to find any statement of hers indicating the nature of the disease that recurred. One must suspicion the possibility of infection here. In my judgment, skin grafting of the ureter is not an alternative for bladder or ureteral anastomosis of it; nor of even a bowel implantation except in the very rarest cases. Should the kidney be in a dangerous condition when grafting of its very short ureter stump is necessary, and it be impossible to unite the two ureteral ends, then skin grafting of the stump may be done. If this be the only kidney, then bowel implantation is preferable. In grafting the ureter to the skin, we should always have in mind the probability of kidney infection and the necessity for nephrectomy.

Implantation of the Ureter into the Vagina.—This operation has been done but three times. Pawlik,¹²² in a woman fifty-seven years of age, having papillomatous masses widely implanted on the neck and posterior surface of the bladder, removed the bladder and made a new one from the vagina, in 1888. He introduced into the urethra a Simon speculum

and catheters in the ureters; then incised the anterior vaginal wall, using the ureteral catheters as guides; sutured the ureters to the vaginal wall and cut them off near the bladder; kept two sounds in the ureters; twenty-five hours later extirpation of the bladder by the suprapubic median incision of ten centimetres. The bladder, filled with iodoform emulsion, was removed to the urethra. The posterior wall of the urethra was sutured to the posterior vaginal wall, and the anterior vaginal and urethral walls were also sutured together. Retropubic and vaginal fistulæ followed, which he later closed. Three years later she was holding urine well, and evacuating it by means of self-catheterization. Chavasse,¹²³ December 6, 1897, operated on a child four years of age suffering from ectopia vesicæ. He implanted the ureters separately into the vagina and dissected away the bladder. November 2, 1898, the patient was presented to the Midland Medical Society as well. Kossinsky,¹¹⁸ of Warsaw, successfully implanted the ureters into the vagina.

Little can be said for this method of dealing with such severe lesions of the urinary organs. While the three cases appear to have been successful, it seems to be grafting a perpetual infirmity upon an individual.

Urethral Grafting of Ureters.—Five cases have been reported in which this operation has been done, in four of which ectopia vesicæ was the condition from which the relief was sought. In the other case death from uræmia resulted, perhaps from the kidney cancer present. It is believed this operation has a limited field, but as a substitute for Maydl's operation for ectopia vesicæ it probably is a failure. Sonnenburg¹²⁴ removed the bladder in ectopia vesicæ and grafted the ureters into the urethra in the glans penis. The patient was obliged to wear a collecting apparatus for the dribbling urine. Esstor¹²⁵ had a case of ectopia vesicæ in which by Sonnenburg's method he did a successful operation. J. Rilus Eastman¹²⁰ had a case of exstrophy of the bladder in which the left kidney was pyonephrotic and the right was in a condition of chronic nephritis. He removed the left kidney and did a Sonnenburg

operation with success. Lindnet,¹¹⁷ of Berlin, in a case of cancer of the bladder, extirpated the entire tumor and implanted one ureter into the urethra. The patient died of uræmia, and the autopsy showed that the implanted ureter had not functionated. The corresponding kidney was the site of a primary cancer. Von Iterson¹¹⁷ has done successfully a Sonenburg operation.

BIBLIOGRAPHY.

- ¹ Simon: *Mathes, Deutsche Zeitsch. f. Chir., Leipzig, 1897, Band xlv, 136-153.*
- ² Smith: *St. Bartholomew Hospital Reports, 1879, Vol. xv, p. 29.*
- ³ Küster: *Verhandl. der deutsche Gesellsch. f. Chir., Berlin, 1891, Band xx, Pt. II, 255-269.*
- ⁴ Chaput: *Arch. Gén. de Méd., Paris, 1894.*
- ⁵ Chaput: *Rev. de Chir., 1893.*
- ⁶ Maydl: *Wien. med. Woch., 1894. Ibid., 1896.*
- ⁷ Duplay: *Arch. Gén. de Méd., 1894.*
- ⁸ Kossinski: (Quoted by Tuffier and Dujarier.)
- ⁹ Rein: *Centralb. f. Gynäk., Leipzig, 1894, Band xviii, 383.*
- ¹⁰ Schopf: *Allg. Wien. med. Zeitsch., 1886.*
- ¹¹ Resegotti: *Gazz. Med. di Torino, 1895, xlv, 917.*
- ¹² Trendelenburg: *Congress of the German Surgical Society, 1895.*
- ¹³ Vasilyeff: *Russk. Chir. Arch., St. Petersburg, February, 1895, i, 569.*
- ¹⁴ Tuffier: *Rev. de Chir. de Paris, 1898, xviii, 277-289.*
- ¹⁵ Leet: *Columbus Medical Journal, 1895, Vol. xv, p. 499.*
- ¹⁶ Bergenhem: *Eira, Stockholm, 1895, xix, 265-268.*
- ¹⁷ Schinkler: *Duvall et Tesson, Ann. d. Mal. d. Org. Gen.-Urin., 1900, xviii, 269-279.*
- ¹⁸ Krynski: *Centralb. f. Chir., 1895, No. 4, p. 73.*
- ¹⁹ Chalot: *Independ. Med., Paris, 1896, ii, 297.*
- ²⁰ Trombetta: *Arch. ed Atti d. Soc. Ital. di Chir., Roma, 1897, xi, 343-352.*
- ²¹ Wölfler: *Wien. klin. Woch., 1896.*
- ²² Casati: *Boari, Ann. d. Org. Gen. Urin., Paris, 1896, xiv, 1-25.*
- ²³ Herczel: *Pest. Med. Chir. Presse, Budapest, 1897, xxxiii, 1125-28.*
- ²⁴ Mikulicz: *Tietze, Beiträge z. klin. Chir., 1897, Band xviii, 1-38.*
- ²⁵ Park, Roswell: *Medical News, 1897, Vol. lxx, p. 702.*
- ²⁶ Fritsch: *Die Krankh. d. weibl. Blase, in Veit's Handb. d. Gynäk., 1897.*
- ²⁷ Fowler: *Brooklyn Medical Journal, 1898, Vol. xii, p. 115.*
- ²⁸ Frank: *Wien. klin. Woch., 1898, No. 43.*
- ²⁹ Schnitzler: *Ibid.*
- ³⁰ Tuffier: *Gaz. Hebd. de Méd., Paris, 1898, iii, 661.*
- ³¹ Pressat: *Boari, Atti Acad. d. Sc. Med. e Nat. in Ferrara, 1898-99, lxxiii, 221-246.*
- ³² Pozza: *Gaz. degli Ospadili e delle cliniche M. 28, 1898.*

- ³¹ Ewald: Wien. klin. Woch., 1898, No. 43.
- ³² Peters: Canada Lancet, 1899-1900, Vol. xxxii, p. 23.
- ³³ Wood: Philadelphia Medical Journal, 1899, Vol. iii, p. 133.
- ³⁴ Herczel: Centralb. f. d. Krankh. d. Harn. u. Sex. Org., Leipzig, 1899, 563-585.
- ³⁵ Von Eiselsberg: Bax. zur Operat. Behandl. d. angeborenen Blassenspalte, etc., Inaug. Dissert., Königsberg, Band i, 1899.
- ³⁶ Wölfler: Mazel Beiträge für klin. Chir., 1899, Band xxiii, 444-497.
- ³⁷ Allen; D. P.: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 259.
- ³⁸ Gersuny: ANNALS OF SURGERY, 1899, Vol. xxx, p. 239.
- ³⁹ Nové-Josserand: Rev. Mens. de Mal. de l'Enf., Paris, 1899, xvii, 258-262.
- ⁴⁰ Albarran: Duval et Tesson, Ann. d. Mal. d. Org. Gen.-Urin., Paris, 1900, xviii, 269-279.
- ⁴¹ Tauffer: Deutsch. med. Woch., 1877, No. 37, p. 438.
- ⁴² Westermarck: Central. f. Chir., Leipzig, 1892, Band xix, 184-188.
- ⁴³ Dunning, L. H.: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 1278.
- ⁴⁴ Krause: Centralb. f. Chir., Leipzig, 1895, Band xxii, 220-226.
- ⁴⁵ Lotheissen: Wien. klin. Woch., 1899, Band xii, 883-888.
- ⁴⁶ Israel, James: Berl. klin. Woch., 1899, Band xxxvi, 201.
- ⁴⁷ Veit: Zeitschr. f. Geb. u. Gynäk., Band xxxi, 462.
- ⁴⁸ Pozzi: Ann. des Mal. d. Org. Gen.-Urin., Paris, 1895, xiii, 428-433.
- ⁴⁹ Schwartz: Rev. de Chir., 1897, xvii, 1045.
- ⁵⁰ Baldwin: Philadelphia Medical Journal, 1898, Vol. ii, p. 1097.
- ⁵¹ Baldy: American Gynecological and Obstetrical Journal, 1896, Vol. ix, pp. 462-467.
- ⁵² Penrose: Medical News, April, 1894.
- ⁵³ Krug: American Gynecological and Obstetrical Journal, 1894, Vol. v, 495-497.
- ⁵⁴ Delageniere: Arch. Méd. d'Angiers, 1897, i, 622-630.
- ⁵⁵ Fühth: Centralb. f. Gynäk., July 16, 1898.
- ⁵⁶ Polk: American Gynecological and Obstetrical Journal, 1898, Vol. xii, p. 200.
- ⁵⁷ Fullerton: American Gynecological and Obstetrical Journal, 1898, Vol. xii, p. 91.
- ⁵⁸ Graupner: Inaug. Dissert., Strasburg, 1897.
- ⁵⁹ Podres: Centralb. f. Chir., 1898, Band xxv.
- ⁶⁰ Hanks: American Gynecological and Obstetrical Journal, 1898, Vol. xiii, p. 273.
- ⁶¹ Noble, G. H.: Transactions of the Southern Surgical and Gynecological Association, 1898, Vol. xi, p. 173.
- ⁶² Wertheim: Monat. f. Geb. u. Gyn., Berlin, 1900, Band xi, 438-452.
- ⁶³ Creutz, Ueber einen Fall von Resect. d. Harnblase mit Verlagerung des Ureters; Inaug. Dissert., Giessen, 1898.
- ⁶⁴ Westermarck: Hygeia, lvii, and Centralb. f. Gynäk., 1895.
- ⁶⁵ Albarran: Ann. d. Mal. d. Org. Gen.-Urin., xiii.

- ⁶⁸ Verkoogen: Soc. belge d. Chir., 1897-98, v, 198-202.
- ⁶⁹ Küster: Arch. d. klin. Chir., Berlin, 1896, 465-472.
- ⁷⁰ Bardenheuer: Verhandl. d. deutsch. Gesellsch. f. Chir., 1891, Band i, 136-143.
- ⁷¹ Novaro: Wien. med. Woch., 1894.
- ⁷² Bottini: Centralb. f. Chir., 1893, No. 27, 596.
- ⁷³ Martin, A.: Monatssch. f. Geb. u. Gynäk., Berlin, 1899, Band x, 446-457.
- ⁷⁴ Kaysar: Centralb. f. Chir., 1897, Band xxiv, 1221-1223.
- ⁷⁵ Ferguson: American Gynecological and Obstetrical Journal, 1898, Vol. xii, p. 629.
- ⁷⁶ Calderini: Ann. di Ost. e Gyn., April, 1899.
- ⁷⁷ Sokoloff: Deutsch. Zeitsch. f. Chir., 1899, Band lii, 185-205.
- ⁷⁸ Bazy: Ann. d. Mal. d. Org. Gén.-Urin., Paris, 1894, xii, 481-499.
- ⁷⁹ Trendelenburg: Cestan, Gaz. Hebdom. de Méd., Paris, 1896, xliii, 181.
- ⁸⁰ Boldt: American Journal of Obstetrics, 1896, Vol. xxiii, pp. 844-858.
- ⁸¹ Mackenrodt: Centralb. f. Gynäk., Leipzig, 1899, Band xxiii, 318-323.
- ⁸² Albarran: Wien. klin. Rundschau, 1897.
- ⁸³ Colzi: Lo Sperimentale, 1895, xlix, "sezione biologica," i, 37.
- ⁸⁴ Rouffart: La Presse Méd., 1897.
- ⁸⁵ Bushbeck: Arbeiten aus der Königl. Frauenkl. in Dresden, 1895, Band ii.
- ⁸⁶ Tuffier: Ann. d. Mal. d. Org. Gén.-Urin., 1895, xiii.
- ⁸⁷ Routier: Ibid., 1897.
- ⁸⁸ Amann: Centralb. f. Gynäk., 1897, 893.
- ⁸⁹ Sängner: Münch. med. Woch., 1899, No. 1.
- ⁹⁰ McMonagle: Transactions of the American Gynecological Society, 1899, Vol. xxi, p. 478.
- ⁹¹ Witzel: Centralb. f. Gynäk., 1896, No. 11.
- ⁹² Davenport: Fenger, ANNALS OF SURGERY, 1894.
- ⁹³ Baumm: Knaggs, Lancet, London, May 27, 1899, p. 1417.
- ⁹⁴ Amann: Centralb. f. Chir., 1898, No. 2.
- ⁹⁵ Kelly: Johns Hopkins Hospital Bulletin, February, 1895, p. 27.
- ⁹⁶ Kelly: American Journal of Gynecology and Obstetrics, 1898, Vol. xii, p. 734.
- ⁹⁷ Lange: ANNALS OF SURGERY, 1899, Vol. xxx, p. 513.
- ⁹⁸ Benkiser: Zeitsch. f. Geb. u. Gynäk., Band xli, Heft 3.
- ⁹⁹ Bovee: ANNALS OF SURGERY, January, 1897.
- ¹⁰⁰ Allen, D. P.: Boston Medical and Surgical Journal, 1899.
- ¹⁰¹ Durante: Soc. Ital. di Chir., sed., October 29, 1895.
- ¹⁰² Gussierow: Charité Annal., 12 jahrg., Thomson.
- ¹⁰³ Labisé: Soc. Belge de Chir., Session January 15, 1899.
- ¹⁰⁴ McMonagle: Transactions of the American Gynecological Society, 1899, Vol. xxiv, p. 478.
- ¹⁰⁵ Winslow: ANNALS OF SURGERY, 1898, Vol. xxvii, p. 46.
- ¹⁰⁶ D'Antona: Boari, Clin. Chir., Milano, 1899, vii, 417-431; 511.
- ¹⁰⁷ Markoe: ANNALS OF SURGERY, 1899, Vol. xxix, p. 693.
- ¹⁰⁸ Reynier: Soc. de Chir., Paris, February 8, 1898. See 106.
- ¹⁰⁹ Schauta: Centralb. f. Gyn., Leipzig, 1899, Band xxiii, 425.

- ¹¹⁰ Sciffart: *Centralb. f. Gynäk.*, No. 4.
- ¹¹¹ D'Urso and De Fabii: *Suppl. al Policlin.*, Roma, 1898-99, vii, 249.
- ¹¹² Krynski: *Centralb. f. Chir.*, 1896, Band iv, 73.
- ¹¹³ Pisani: *Policlin.*, Roma, 1896, iii-C, 333-338.
- ¹¹⁴ Martin, F. H.: *Journal of the American Medical Association*, 1899, Vol. xxxii, p. 709.
- ¹¹⁵ Petersen, R.: *Ibid.*, February 24, 1900.
- ¹¹⁶ Edmunds and Ballance: *St. Thomas's Hospital Reports*, London, 1887, Vol. xvi, pp. 201-207.
- ¹¹⁷ Trekaki, Les Greffes Uretérales, Thèse de Par., 1899.
- ¹¹⁸ See Modlinsky: *Centralb. f. d. Krankh. d. Harn-Sex. Org.*, Leipzig, 1894, Band v, 198-205.
- ¹¹⁹ Laurenzi: See Trekaki, 127.
- ¹²⁰ Budinger: *Arch. f. klin. Chir.*, 1894, Band xlviii, 639-682.
- ¹²¹ Harrison, R.: *Lancet*, London, 1897, Vol. i, p. 1091.
- ¹²² Pawlik: *Wien. klin. Woch.*, 1891, Band xli, 1814-1815.
- ¹²³ Chavasse: *Lancet*, 1899, Vol. i, p. 161.
- ¹²⁴ Sonnenburg: *Verhandl. d. deutsch. Gesellsch. f. Chir.*, 1882, Band x, p. 158.
- ¹²⁵ Estor, N.: *Montpellier Méd.*, 1899, viii, 39-44.
- ¹²⁶ Eastman: *Journal of the American Medical Association*, 1899, Vol. xxxiii, p. 263.
- ¹²⁷ Trekaki, P.: *Du Meat. Uretéral artificiel, Étude Clin. et Expérimentale*, Paris, 1892.
- ¹²⁸ Trekaki: *Bull. Soc. Anat. de Paris.*, 1892, lxxvii, 150-157.